CLAIMS

1. A frame communication system comprising:

a frame-synchronize-information adder for adding a frame-synchronize-information to a frame;

a transmitter for transmitting the frame including the frame-synchronize-information;

a receiver for receiving the frame from the transmitter; and

a frame synchronizer for executing a frame synchronization adjustment referring to the frame-synchronize-information included in the frame.

2. A frame transmitting device comprising:

a frame-synchronize-information adder for adding frame-synchronize-information to a frame; and

a transmitter for transmitting the frame with the frame-synchronize-information.

3. A frame receiving device comprising:

a receiver for receiving a frame accompanying with a frame-synchronize-information; and

a frame synchronizer for executing a frame synchronization adjustment referring to the frame-synchronize-information.

4. A frame communication system according to claim 1 further comprising:

a receiver side clock circuit which provides first

clock pulses; and

a transmitter side clock circuit which provides second clock pulses in synchronization with the same phase or a different phase with respect to the first clock pulses provided by the receiver side clock circuit,

wherein the frame-synchronize-information adder adds the frame-synchronize-information to the frames according to the first clock pulses, and the frame synchronizer executes the synchronization adjustment according to the second clock pulses.

5. A frame transmitting device according to claim 2, wherein the frame-synchronize-information is determined according to an expected delay time of the frame.

6. A frame receiving device according to claim 3, wherein the frame synchronizer executes the synchronization adjustment according to an expected delay time required for the frame to reach the frame synchronizer.

7. A frame transmitting device according to claim 5, wherein the expected delay time is equal to the sum of a maximal delay time estimated for the frame, and an estimated maximal phase difference between first and second clock pulses.

8. A frame receiving device according to claim 6, wherein the expected delay time is equal to the sum of a maximal delay time estimated for the frame, and an estimated maximal

phase difference between first and second clock pulses.

9. A frame transmitting device according to claim 5, wherein the expected delay time is determined according to a service type provided by the frame.

10. A frame receiving device according to claim 6, wherein the expected delay time is determined according to a service type provided by the frame.

11. A frame transmitting device according to claim 5, wherein, when a real delay time exceeds the expected delay time, the expected delay time is updated.

12. A frame receiving device according to claim 6, wherein, when a real delay time exceeds the expected delay time, the expected delay time is updated.

13. A frame communication system according to claim 4, further comprising:

a transmission control circuit which determines the frame-synchronize-information according to a correction value; and

a reception control circuit which provides an alarm signal to the transmission control circuit when the reception control circuit finds that the frame synchronizer is unable to achieve the synchronization adjustment,

wherein, when the transmission control circuit receives the alarm signal, the transmission control circuit

updates the correction value.

14. A frame communication system according to claim 13, further comprising:

at least one other frame-synchronize-information adder; and

a selection circuit which selects one frame from the frames provided by the plurality of frame-synchronize-information adders, and provides the selected frame to the frame synchronizer.

15. A frame communication system according to claim 14, further comprising:

a combining circuit;

wherein the frame synchronizer executes synchronization adjustment of the plurality of frames provided by the frame-synchronize-information adders, and the combining circuit combines the adjusted frames into one frame.

16. A frame communication system according to claim 14, further characterized in that the selection circuit selects one frame based on any informations included in the frames.

17. A frame communication system according to claim 1, further comprising:

a copying means which copies a frame with the frame-synchronize-information, thereby creating a plurality of frames;

a plurality of physical or logical transmission routes which transmit the frames separately;

a plurality of radio transmitters which transmit the plurality of frames transmitted through the transmission routes, at timings determined by the frame-synchronize-information attached thereto; and

a plurality of terminals to receive in a diversity manner the frames transmitted from the radio transmitters.

18. A frame transmitting device according to claim 5, further comprising:

at least one other frame-synchronize-information adder, the frame-synchronize-information adders are provided corresponding to a plurality of transmission routes, respectively;

a plurality of clock circuits provided corresponding to the frame-synchronize-information adders, respectively, and generates respective clock pulses; and

a correction means which corrects the frame-synchronize-informations according to phase differences of respective clock pulses from a reference clock pulse.

19. A frame receiving device according to claim 6, further comprising:

at least one other frame synchronizer;

a plurality of clock circuits which are provided corresponding to the frame synchronizers, respectively, for provide respective clock pulses; and

a correction means which corrects the frame-

synchronize-informations according to phase differences of respective clock pulses from a reference clock pulse.

20. A frame transmitting device according to claim 18, further comprising:

an information transmitting means which transmits information over radio links according to the phases of the respective clock pulses; and

a receiving means which receives phase difference data from a radio communication terminal, the radio communication terminal measuring phase differences between the information and a reference clock signal, so as to make the phase difference data,

wherein the correction means corrects the frame-synchronize-information based on the phase difference data informed by the radio communication terminal.

wherein the correction means corrects the frame sync information based on the phase differences informed by the radio communication terminal.

21. A frame receiving device according to claim 19, further comprising:

an information transmitting means which transmits information over radio links according to the phases of the respective clock pulses; and

a receiving means which receives phase difference data from a radio communication terminal, the radio communication terminal measuring phase differences between the information and a reference clock signal, so as to make the phase

difference data,

wherein the correction means corrects the frame-synchronize-information based on the phase difference data informed by the radio communication terminal.

wherein the correction means corrects the frame sync information based on the phase differences informed by the radio communication terminal.

22. A frame communication system according to claim 4, wherein the first and second clock pulses have a different phase from each other.

23. A frame communication system according to claim 4, wherein a plurality of the transmitter side clock circuits are implemented in accordance with a plurality of transmission routes, and at least one of the first clock pulses generated by the transmitter side clock circuits has a different phase from those of the other first clock pulses.

24. A frame communication system according to claim 4, wherein a plurality of the receiver side clock circuits are implemented in accordance with a plurality of transmission routes, and at least one of the second clock pulses generated by the receiver side clock circuits has a different phase from those of the other second clock pulses.

25. A frame receiving device according to claim 6, wherein the expected delay time is determined according to a difference in timing between the frame-synchronize-

information attached to a frame received in the past, and an actual time of reception of the same frame.

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26. A frame receiving device according to claim 25, wherein the expected delay time is determined by obtaining a difference in timing between the frame-synchronize-information attached to a frame received in the past, and an actual time of reception of the same frame, and by adding a predetermined safety factor to the difference.

27. A frame communication system according to any one of claims 1, 4, 13-17, and 22-24 wherein the frame-synchronize-information adder adds a reliability information of the frame to the frame-synchronize-information.

28. A frame transmitting device according to any one of claims 2, 5, 7, 9, 11, 18 and 20 wherein the frame-synchronize-information adder adds a reliability information of the frame to the frame-synchronize-information.

29. A frame receiving device as described in one of claim 3, 6, 8, 10, 12, 18, 21, 25 or 26 wherein quality of the received frame is evaluated according to the frame-synchronize-information.

30. A frame transmitting device according to claim 28, wherein the reliability information includes information indicative of transmission condition of the frame before the frame is provided to the frame-synchronize-information adder.

31. A frame receiving device as described in claim 29 wherein the reliability information includes information indicative of transmission condition of the frame before the frame-synchronize-information is added to the frame.

32. A frame transmitting device according to claim 30, wherein the information indicative of transmission condition indicates a disconnection state of transmission.

33. A frame receiving device according to claim 31, wherein the information indicative of transmission condition indicates a disconnection state of transmission.

34. A method for frame communication comprising the steps of:

adding frame-synchronize-information to a frame;

transmitting the frame with the frame-synchronize-information;

receiving the frame transmitted by the transmitter; and

executing a frame synchronization adjustment referring to the frame-synchronize-information attached to the received frame.

35. A method for frame transmission comprising the steps of:

adding frame-synchronize-information to a frame; and

transmitting the frame with the frame-synchronize-

information.

36. A method for frame reception comprising:

receiving a frame accompanying with frame-synchronize-information; and

executing a frame synchronization adjustment referring to the frame-synchronize-information attached to the frame.

37. A frame transmitting device according to claim 11, wherein a time length introduced for updating the expected delay time is constant regardless of an overtime of a real delay time exceeding the expected delay time.

38. A frame receiving device according to claim 12, wherein a time length introduced for updating the expected delay time is constant regardless of an overtime of a real delay time exceeding the expected delay time.

39. A method for frame transmission according to claim 35, further comprising a step for determining timing for adding the frame-synchronize-information differently from the timing for transmitting a previous frame transmitted before the onset of current communication, whereby a plurality of frame communications are executed simultaneously.